

CLAIMS

1. A switching unit for switching a data packet, the switching unit comprising:

- 5 - a plurality of devices each adapted to receive incoming data packets from an external network on an input port and transmit outgoing data packets through an output port to the external network,
- means for interconnecting the plurality of devices in a ring configuration so as to enable communication of data between the plurality of devices,
- 10 - means for determining, for each incoming data packet, a receiving device to receive and output the data packet, and to generate corresponding receiving device information, and
- means for transporting the receiving device information from the determining means to the devices,

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the devices being adapted to:

- select one or more data packets to be switched, each data packet being held by a respective device, and
- 20 - a first number of times:
 - forward, at least substantially simultaneously, at least part of each of the data packets and pertaining receiving device information to a next device along the interconnecting means,
 - receive, at least substantially simultaneously and from the interconnecting means, the at least part of the selected data packets and the pertaining receiving device information, and
 - determine, at least substantially simultaneously in each device having received at least part of a data packet, on the basis of the pertaining receiving device information, whether the at least part of the data packet is intended for the
- 25 - device and, if so, storing a copy of the at least part of the data packet in the device,
- 30 -

wherein:

- the transporting means interconnects the determining means and the devices in a daisy chain manner, the determining means being positioned at one end of the daisy chain and a final device at another end thereof,
- the determining means is adapted to output receiving device information for the devices a predetermined number of times and to perform each outputting at least substantially simultaneously with a forwarding step of the devices, and
- the devices, except the final device, being adapted to:
 - receive receiving device information from a previous device or the determining means along the transporting means, the receiving being performed at least substantially simultaneously with the receiving of the at least part of the data packets, and
 - forward at least part of the received receiving device information to a subsequent device along the transporting means, the forwarding being performed at least substantially simultaneously with the forwarding of the at least part of the data packets.

2. A unit according to claim 1, wherein the interconnecting means and the transporting comprise a plurality of parallel connections between the devices.
- 20 3. A unit according to claim 2, wherein a first number of the parallel connections are adapted to transport the at least part of the data packets between the devices and where a second number of the parallel connections are adapted to transport the pertaining receiving device information between the devices.
- 25 4. A unit according to claim 1, wherein each of the devices is adapted to, when determining whether the at least part of the data packet is intended for the device, use only part of the receiving device information in the determination.

5. A unit according to claim 1, wherein the determining means comprise:
 - 30 - means for, on the basis of at least part of a data packet, providing receiving device identification, and
 - an arbiter adapted to:
 - receive the receiving device identification relating to a number of data packets,

- select, on the basis of the receiving device identification, a switching order of the data packets, and
 - output to the transporting means receiving device information relating to data packets at least part of each of which may be transported on the 5 interconnecting means at the same time.
6. A unit according to claim 5, wherein the arbiter is adapted to output, each of the predetermined number of times, receiving device information for one device, where the receiving device information is output in an order corresponding to the order of the 10 devices on the transport means.
7. A unit according to claim 1, wherein the devices are adapted to select the one or more data packets to be switched in accordance with receiving device information received from the determining means. 15
8. A unit according to claim 1, further comprising means for receiving or providing a clocking signal having a number of timely spaced pulses, and wherein the devices are adapted to perform, in each of the number of times, each receiving step in accordance with the same pulse(s), each forwarding step in accordance with the same pulse(s), and 20 each determination step in accordance with the same pulse(s).
9. A unit according to claim 8, wherein the devices each are adapted to perform the receiving, forwarding and determination steps relating to one of the first number of times, in correlation to the same pulse. 25
10. A unit according to claim 1, wherein the first number of times is equal to the number of devices on the interconnecting means.
11. A unit according to claim 1, wherein the devices are adapted to perform a second 30 number of super cycles each comprising the first number of times of the selecting, forwarding, receiving and determining steps, and wherein the devices in one super cycle are adapted to select the data packets in accordance with receiving device information output by the determining means in a previous super cycle.

12. A unit according to claim 1, wherein the devices are adapted to establish a priority for each incoming data packet.

13. A unit according to claim 1, wherein:

- 5 - the devices are adapted to establish, for each incoming data packet, control information relating to a destination address, a source device identity, and a priority, and to provide the determining means with the control information,
- the determining means being adapted to provide the receiving device information on the basis of the control information.

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14. A unit according to claim 1, wherein the devices are also adapted to, the first number of times, alter the receiving device information received from the interconnecting means and forward the altered receiving device information to the subsequent device along the interconnecting means.

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15. A unit according to claim 14, wherein the receiving device information is a bit mask having a bit relate to each of the devices, and wherein the devices are adapted to alter the receiving device information by shifting the bit mask by a predetermined number of bits.

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16. A unit according to claim 15, wherein each device is adapted to determine that the at least part of the data packet is intended for the device when a bit at a predetermined position in the bit mask has a predetermined value.

25 17. A switching unit for switching a data packet, the switching unit comprising:

- a plurality of devices each adapted to receive incoming data packets from an external network on an input port and transmit outgoing data packets through an output port to the external network,
- 30 - means for determining, for each incoming data packet, a receiving device to receive and output the data packet, and to generate corresponding receiving device information, and
- means for interconnecting the plurality of devices in a ring configuration so as to enable communication of data between the plurality of devices,

- means for transporting the receiving device information from the determining means to the devices,

the devices being adapted to:

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- select one or more data packets to be switched, each data packet being held by a respective device, and
- a first number of times:
 - forward, at least substantially simultaneously, at least part of each of the data packets and pertaining receiving device information to a next device along the interconnecting means,
 - receive, at least substantially simultaneously and from the interconnecting means, the at least part of the selected data packets and pertaining receiving device information, and

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- determine, at least substantially simultaneously in each device having received at least part of a data packet, from the pertaining receiving device information, whether the at least part of the data packet is intended for the device and, if so, storing a copy of the at least part of the data packet in the device,

15 20 wherein the first number of times is identical to the number of devices.

18. A unit according to claim 17, wherein an additional element, such as a CPU, is connected to a device, and wherein the device is adapted to, on the basis of receiving device information received, determine whether the pertaining at least part of a data 25 packet received is to be output by the output port of the device or to be transmitted to the additional element.

19. A unit according to claim 17, wherein at least one of the devices has a number of output ports, the at least one of the devices being adapted to forward all data packets 30 received to the interconnecting means.

20. A device for use in the unit according to claim 1, the device comprising:

- means for receiving at least part of a data packet and pertaining receiving device information from the interconnecting means,

- means for determining, on the basis of the receiving device information, whether the at least part of the data packet is intended for the actual device,
 - means for copying the at least part of the data packet if the at least part of the data packet is intended for the actual device,
 - 5 - means for forwarding the at least part of the data packet and pertaining receiving device information to a subsequent device along the interconnecting means,
 - means for receiving receiving device information from the transporting means, and
 - means for forwarding at least part of the receiving device information along the transporting means,
- 10 the device being adapted to perform the receiving steps simultaneously and the forwarding steps simultaneously.
21. A device according to claim 20, wherein the means for determining whether the at least part of the data packet is intended for the actual device are adapted to perform the determination using only part of the receiving device information.
- 15 22. A device according to claim 20, wherein the means for receiving and forwarding the at least parts of the data packets and receiving device information on the interconnecting means comprise means for receiving and forwarding a plurality of parallel connections of the interconnecting means.
- 20 23. A device according to claim 22, wherein the means for transmitting and receiving the at least parts of the data packets and pertaining receiving device information are adapted to transmit and receive the at least part of the data packet over a first number of the parallel connections between the devices and the receiving device information over a second number of the parallel connections between the devices.
- 25 24. A device according to claim 20, further comprising means for altering the receiving device information received from the interconnecting means.
- 30 25. A device according to claim 24, wherein the receiving device information is a bit mask, and wherein the altering means are adapted to alter the receiving device information by shifting the bit mask by a predetermined number of bits.

26 A device according to claim 25, wherein the means for determining whether the at least part of the data packet is intended for the actual device is adapted to determine this when a bit in the bit mask at a predetermined position has a predetermined value.

5 27. A method of switching a data packet in a switching unit comprising:

- a plurality of devices adapted to receive incoming data packets from an external network on an input port and transmit outgoing data packets through an output port to said external network,
- means for determining, for each incoming data packet, a receiving device to receive and output the data packet and for generating corresponding receiving device information,
- means for interconnecting the plurality of devices in a ring configuration so as to enable communication of data packets between the plurality of devices, and
- transporting means interconnecting the determining means and the devices in a daisy chain manner, the determining means being positioned at one end of the daisy chain and a final device at another end thereof,

where each of the devices is adapted to:

- receive at least part of a data packet and pertaining receiving device information from the interconnecting means,
- determine, on the basis of the receiving device information, whether the pertaining at least part of the data packet is intended for the actual device,
- copy the at least part of the data packet if the at least part of the data packet is intended for the actual device, and
- forward the at least part of the data packet and pertaining receiving device information to a subsequent device along the interconnecting means,

the method comprising a super cycle comprising the steps of:

30 at least substantially simultaneously selecting one or more data packets to be switched, each data packet being held by a respective device, and

a number of times:

- at least substantially simultaneously:

- forward at least part of each of the data packets and pertaining receiving device information from one device to a next device along the interconnecting means,
- output, from the determining means, receiving device information to a subsequent device along the transporting means,
- 5 - forward, in each device having received receiving device information from the transporting means, at least part of the received receiving device information to a subsequent device on the transporting means,
- at least substantially simultaneously:
 - 10 - receive from the interconnecting means the at least part of the selected data packets and pertaining receiving device information, and
 - receive the receiving device information from the transporting means,
 - at least substantially simultaneously, in each next device receiving at least part of a data packet, determine, on the basis of the pertaining receiving device
- 15 information, whether the at least part of the data packet is intended for the actual device.

28. A method according to claim 27, wherein the step of forwarding information along the interconnecting means comprises transmitting the information along a plurality of parallel 20 connections between the devices.

29. A method according to claim 28, wherein the step of forwarding information along the interconnecting means comprises transmitting the data packets along a first number of the parallel connections between the devices and the receiving device information along a 25 second number of the parallel connections between the devices.

30. A method according to claim 27, wherein the step of determining whether the at least part of the data packet is intended for the actual device uses only part of the pertaining receiving device information.

31. A method according to claim 27, comprising a number of super cycles wherein, in one or more first super cycle(s), the determining means determines, on the basis of at least part of a number of data packets received by the devices, the corresponding receiving device information, and outputs receiving device information relating to data packets at

least part of which may be transported simultaneously on the interconnecting means in a subsequent super cycle.

32. A method according to claim 27, further comprising providing a clocking signal having 5 a number of timely spaced pulses, and wherein:

- in accordance with the same pulse(s), each device performs the forwarding steps and the determining means performs the outputting step,
- in accordance with the same pulse(s), each device performs the receiving steps, and
- 10 - in accordance with the same pulse(s), each device performs the determining step.

33. A method according to claim 27, wherein the forwarding steps, receiving steps, and determining steps in a super cycle are each performed a number of times equal to the number of devices in the unit.

15 34. A method according to claim 27, further comprising the step of a device establishing a priority for each data packet received by a device.

35. A method according to claim 27, further comprising the steps of:
20 - the devices establishing, for each incoming data packet, control information for each incoming data packet, control information comprising information relating to a destination address, a source device identity, and a priority and providing the determining means with the control information,
- the determining means providing the receiving device information on the basis of 25 the control information received.

36. A method according to claim 27, further comprising the step of the devices altering the receiving device information received from the transporting means before forwarding the received information to the next device on the transporting means.

30 37. A method according to claim 36, wherein the receiving device information is a bit mask having a bit relate to each of the receiving devices of the plurality of devices, and wherein the step of altering the bit mask comprises shifting the bit mask by a predetermined number of bits.

38. A method according to claim 37, wherein the step of determining, on the basis of the pertaining receiving device information, whether the at least part of the data packet is intended for the device is performed on only part of the receiving device information.

5 39. A method of switching a data packet in a switching unit comprising:

- a plurality of devices adapted to receive incoming data packets from an external network on an input port and transmit outgoing data packets through an output port to said external network,
- means for determining, for each incoming data packet, a receiving device to receive and output the data packet and for generating corresponding receiving device information, and
- means for interconnecting the plurality of devices in a ring configuration so as to enable communication of data packets between the plurality of devices,

10 15 where each of the devices is adapted to:

- receive at least part of a data packet and pertaining receiving device information,
- determine, on the basis of the receiving device information, whether the pertaining at least part of a data packet is intended for the actual device,
- copy the at least part of the data packet if the at least part of the data packet is intended for the actual device, and
- forward the at least part of the data packet and pertaining receiving device information to a subsequent device along the interconnecting means,

20 the method comprising the steps of:

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- selecting, at least substantially simultaneously, one or more data packets to be switched, each data packet being held by a respective device, and
 - a number of times:
 - forwarding, at least substantially simultaneously, at least a part of each of the data packets and pertaining receiving device information from one device to a next device along the interconnecting means,
 - receiving, in the next devices and at least substantially simultaneously, the at least part of the selected data packets and pertaining receiving device information, and
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- determining, at least substantially simultaneously in each next device receiving at least part of a data packet, whether the at least part of the data packet is intended for the device and, if so, storing a copy of the at least part of the data packet in the device,

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wherein the number of times equals the number of devices.

40. A method according to claim 39, wherein an additional element, such as a CPU, is connected to a device, and wherein the device, on the basis of receiving device information received, determines whether the pertaining at least part of a data packet received is to be output by the output port of the device or to be transmitted to the additional element.

41. A method according to claim 39, wherein at least one of the devices has a number of output ports, the at least one of the devices forwarding all incoming data packets to the interconnecting means.

42. A switching unit for switching a data packet, the switching unit comprising:
- a plurality of devices each adapted to receive incoming data packets from an external network on an input port and transmit outgoing data packets through an output port to the external network,
- means for determining, for each incoming data packet, a receiving device to receive and output the data packet and for generating corresponding receiving device information, and
25 - means for interconnecting the plurality of devices in a ring configuration so as to enable communication of data packets between the plurality of devices,

where each of the devices is adapted to:
- receive at least part of a data packet and pertaining receiving device information along the interconnecting means from another device,
30 - determine, on the basis of the receiving device information, whether the at least part of the data packet is intended for the actual device,
- copy the at least part of the data packet if the at least part of the data packet is intended for the actual device,
35 - alter the receiving device information, and

- forward the at least part of the data packet and altered pertaining receiving device information to a subsequent device along the interconnecting means.

43. A switching unit according to claim 42, wherein all devices are adapted to perform, 5 during the step of determining whether the at least part of the data packet is intended for the device, the same determination method.

44. A switching unit according to claim 42, wherein all devices are adapted to perform, during the step of determining whether the at least part of the data packet is intended for 10 the device, the determination on only a predetermined part of the receiving device information.

45. A switching unit according to claim 44, wherein the predetermined part of the receiving device information is a predetermined bit of the receiving device information.

15 46. A switching unit according to claim 45, wherein the receiving device information is a bit map and wherein all devices are adapted to, during the altering step, shift the bit map a predetermined number of bits.

20 47. A switching unit according to claim 42, wherein all devices are adapted to have an identical operation.

48. A switching unit according to claim 42, wherein all devices are identical.

25 49. A method of switching a data packet in a switching unit comprising:
- a plurality of devices adapted to receive incoming data packets from an external network on an input port and transmit outgoing data packets through an output port to said external network,
- means for determining, for each incoming data packet, a receiving device to 30 receive and output the data packet and for generating corresponding receiving device information, and
- means for interconnecting the plurality of devices in a ring configuration so as to enable communication of data packets between the plurality of devices,

- transporting means interconnecting the determining means and the devices in a daisy chain manner, the determining means being positioned at one end of the daisy chain and a final device at another end thereof,

5 the method comprising, in each device, the steps of:

- receive at least part of a data packet and pertaining receiving device information,
- determine, on the basis of the receiving device information, whether the at least part of the data packet is intended for the actual device,
- copy the at least part of the data packet if it is intended for the actual device,
- 10 - alter the receiving device information received, and
- forward the at least part of the data packet and altered pertaining receiving device information to a subsequent device along the interconnecting means.

50. A method according to claim 49, wherein all devices perform, during the step of
15 determining whether the at least part of the data packet is intended for the device, the
same determination method.

51. A method according to claim 49, wherein all devices perform, during the step of
determining whether the at least part of the data packet is intended for the device, the
20 comparison on a predetermined part of the receiving device information, all devices
performing the comparison at the same position in the receiving device information.

52. A method according to claim 51, wherein the predetermined part of the receiving
device information is a predetermined bit of the receiving device information.

25 53. A method according to claim 52, wherein the receiving device information is a bit map
and wherein all devices, during the altering step, shift the bit map a predetermined
number of bits.

30 54. A switching unit according to claim 49, wherein all devices have an identical
operation.

55. A method according to claim 49, wherein all devices perform, during the altering step,
the same altering procedure.

56. A method according to claim 55, wherein the altering procedure is a shifting of a bit map a predetermined number of bits.

57. A device for use in the unit according to claim 43, the device comprising:

- 5 - means for receiving at least part of a data packet and pertaining receiving device information,
- means for determining, from the receiving device information, whether the pertaining at least part of the data packet is intended for the actual device,
- means for copying the at least part of the data packet if the at least part of the data 10 packet is intended for the actual device,
- means for altering the receiving device received, and
- means for forwarding the at least part of the data packet and altered pertaining receiving device information to a subsequent device.

15 58. A device according to claim 57, the device being adapted to perform the determination of whether the at least part of the data packet is intended for the device on only part of the receiving device information.

59. A switching unit according to claim 57, wherein the receiving device information is a 20 bit map and wherein the device is adapted to, during the altering step, shift the bit map a predetermined number of bits.